DOCUMENT RESUME

ED 173 881 CS 502 586

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TITLE Approaching the Comparison of Competing Studies.
PUB DATE Oct 77
NOTE 27p.; Paper presented at the Northeastern Educational Research Association/National Council of Measurement in Education Conference (Ellenville, New York, October 26-28, 1977); Not available in paper copy due to marginal legibility of original document; Figure 1 may not reproduce well due to small type

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Communication (Thought Transfer); *Literature Reviews; *Organization; *Research Criteria; *Research Methodology; Research Problems; Research Reviews (Publications); *Social Science Research; *Speech Communication; Technical Writing

ABSTRACT

This paper addresses the problems posed by the staggering volume of research in human communication and by vital supportive studies in social and behavioral sciences, as well as the difficulties in comparing competing studies to determine greatest usefulness and merit. The paper describes an approach to the systematic consideration and evaluation of competing research that focuses on improving the internal structuring of certain segments of the review of research literature--such as the sorting and classification of documents based on the researcher's focus, range of convenience, and the purpose and nature of the reported research, as well as the comparison and analysis of competing studies. (DF)

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APPROACHING THE COMPARISON OF COMPETING STUDIES

Abstract

The volume of literature is staggering. Beyond identifying relevant works, the researcher and student eventually faces the problem of comparing and making decisions concerning the merit of "competing" studies. This paper outlines an approach to such comparisons, suggests criteria for the process and presents a brief example of it.

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APPROACHING THE COMPARISON OF COMPETING STUDIES

PROBLEM AND PURPOSE

The volume of research literature in human communication is prodigious. Add to it vital supportive studies from sister social and behavioral sciences and the volume of research a student or professional in communication must contend with is staggering.

But, volume is not the only problem. Upon identification of literature directly related to a topic of concern, the serious student or professional frequently faces the necessity of comparing "competing" studies and applying some decision system to determine which are of the greatest use and merit. Such comparisons are a distinctly different problem in research but they are very directly related to concerns commonly addressed in research design and methodology.

Such comparisons are also a problem which we tend to ignore in teaching research design and methodology. The frequent result of this oversight seems to be one or more of the following outcomes based upon observation of the literature and of students' research proposals, theses and dissertations:

1. A tendency to restrict one's view to a favored research approach or methodology. That is to say, there is a pronounced proclivity to invoke a selective bias when approaching the literature based upon the individual's convictions concerning research.

2. Where research using different approaches is considered, there is a tendency to invoke the same selective bias when deciding usefulness or merit.

3. A tendency not to differentiate among studies of a similar (and favored) type. That is studies are accepted on the basis of their generic nature rather than their relative strength.

4. A tendency not to analyze and report the relative strength of competing studies.

The purpose of this discussion is to describe an approach to the systematic consideration and evaluation of competing research. Competing research is broadly defined as research focusing on a similar phenomenon, and doing so with a similar "range of convenience". Range of convenience in this context refers to the specific interest of the researcher in relation to the phenomenon. For example, if the phenomenon was that which we now call "communication apprehension" our range of convenience for competing studies might be either measurement or clinical treatment, but not both.

Beyond describing an approach to the evaluation of competing research, the discussion includes reflections and conclusions resulting from a few attempts to employ the system.

SCOPE OF THE SYSTEM

A systematic review and evaluation of a specified area of research literature may include the following steps:

1. Identification of sources and collection of documents
2. Sorting and classification of documents based upon the researcher's focus and range of convenience, the purpose and nature of the reported research, and similar relevant factors.
3. Selection of relevant documents for detailed analysis.
4. Identification of potentially "competing" studies.
5. Comparison and analysis of competing studies.
6. Analysis of non-competitive studies.
7. Interpretation and reporting.

The system discussed herein, which is concerned with structuring information about studies for subsequent decision making, focuses on steps 2, 4, and 5. However, it aids in structuring information about individual studies for use in steps 3 and 6. Step 1 is an information system concern. Steps 2 and 5 are data development concerns. Step 7 is a creative function involving decision-making based upon the outputs of steps 5 and 6. Steps 3 and 4 are decision functions utilizing information structured in step 2.

This discussion does <u>not</u> recommend a complete restructuring of commonly employed approaches to the review of research literature. It focuses on improving the internal structuring of certain segments of it (steps 2 and 5). In turn, the recommended restructuring of step 2. yields more comparable data for decision making in step 4. The restructuring strives to improve the quality of data considered in the total literature review and analysis process with the underlying belief that such improvement is an essential first step in overcoming some of the shortcomings enumerated at the outset of this discussion.

SYSTEM VALUES

Any system imposes a value structure on the object(s) of its systemization. The sequence of the system imposes a logic form which --while popular or widely accepted-- tends to denigrate those objects which do not conform to it. Similarly, the content substance dealt with by the system, and the manner in which the system categorizes and differentiates qualities of input, imposes those values inherent in the system.

This system is recognized as being value laden. Its scales "value" various qualities, styles and end results of research above others. However, if one can overcome the temptation to use the proposed scales for comparison of studies in a "good" and "bad" context, the system can become a tool for decision makers. Where the temptation can be avoided, the user can use the system as an abstraction and impose his or her hierarchy of values.

The values in this system favor those studies which:

1. use basic research types which offer the greatest generalizability of results,

2. are highly specific in defining the research focus and its relationship to a field of study, extant conditions and problems,

3. use research designs which offer greater generalizability,
4. decrease the artificiality of the independent variable,
5. stress "instrumentality" analyses and higher data types.
6. use instrumentation which decreases possible subject or researcher bias,

7. uses larger samples, and
8. use sampling techniques which decrease researcher influence on outcomes.

This system does not adequately deal with some kinds of research. For instance, philosophical or theory building research may not be classifiable beyond the most simplistic levels on some scales and may not even be classifyable on others. However, the system does make it possible to deal with the huge volume of literature which strives to emulate research in the tradition of the physical sciences.

DOCUMENT CLASSIFICATION

Step 2 concerns "sorting and classification of (identified) documents based upon the researcher's focus and range of convenience, the purposes and nature of the related research, and similar relevant factors". The object of the process is to structure information reported in a standardized manner to:

1. systematize review of literature along certain predetermined lines,
2. simplify the process of grouping like studies on a variety of bases (such as research focus, range of convenience, research characteristics, etc.), and
3. "assure" (through common information formating) that studies are sorted, classified, and selected or rejected upon the consideration of common qualities (or the lack of them).

The document classification process of this system utilizes a standard form which calls for entries of the following data abstracted from each report:

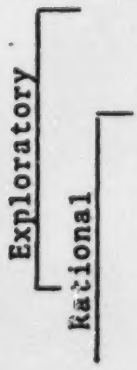
Identification Information

1. Author(s)
2. Title
3. Publication/publisher/date/volume/issue
4. Pages (if applicable)

Research Focus

1. Field within which study is identified
2. Area(s) of interest
3. Conditions relevant to interest area(s)
4. Underlying problem(s) of identified condition(s)
5. Research focus related to problem(s) and scope delimitations.
6. Questions, pusposes, hypotheses

Type of Research[1]



1. Historical
2. Critical
3. Descriptive
4. Developmental/System Analytic
5. Field
6. Case

[1]Types of research listed are adapted from a variety of sources (Kerlinger (1964), Campbell and Stanley (1963), Isaac (1971), among others). Action research as a category is best defined by Isaac, 1971.

7. Correlational
8. Causal/comparative
9. Experimental
10. Field Experimental

Causal

11. Action
12. Theory Integration/Extension
13. Philosophical

Creative

Research Design

1. Test and Treatment Sequence
2. Design constants, isolates and controls[2]
   a. Subject related
      1). History
      2). Maturation
      3). Mortality
   b. Sampling related
      4). Regression
      5). Selection
   c. Procedure related
      6). Testing
      7). Instrumentation
   d. Interactions
      8). Selection/Maturation
      9). History/Maturation
      10). Testing/Treatment

[2]Campbell and Stanley (1963) noted most of these as sources of internal and external validity in research designs.

11). Selection/Treatment

12). History/Maturation/Treatment

13). History/Maturation/Testing/Treatment

3. Sample Data

a. Type: convenience
quota
matched
random

b. Size

c. Population description

4. Nature of Stimulus (independent variable(s)

a. Researcher assigned

1). Form and content satisfy design consideration or convenience.

2). Form and content hypothesized as relevant to sample study.

b. Subject assigned

3). Form selected by subjects; content selection by experimenter.

4). Form and content fit established historical or use patterns of subject population.

c. Naturally occuring

5). Form and content match basic nature of natural events.

6). Use of naturally occuring events.

5. Tests/measures

   a. Instruments

      1). Projective

      2). Direct - Subject controlled

      3). Direct - Instrumentation

   b. Instrument reliability and validity

   c. Analysis type(s) and statistical tests

      1). Descriptive/quantity

      2). Relation

      3). Instrumentality

   d. Data type

      1). Nominal

      2). Ordinal

      3). Internal

      4). Ratio

Conclusions/Inferences of Research

1. Conclusions
2. Conformity of conclusions to stated design capabilities
3. Suggested areas for further study

The foregoing, structured as illustrated in Figure 1, yields a reasonably concise, but detailed, view of important aspects of reported studies.

DOCUMENT SELECTION FOR COMPARATIVE ANALYSIS

The classification of documents suggested above does not yield an automatic decision concerning which studies are "competitive" or "comparable". It does organize data for such decisions in step 4 of the general process described.

IDENTIFICATION INFORMATION

TITLE:_____ ( )BOOK ( ) ARTICLE ( )OTHER:_____

AUTHOR:_____ PUBLICATION/PUBLISHER:_____ PAGES:_____ (if applicable)

EDITION(If applicable):_____ VOLUME(If applicable):_____ ISSUE(If applicable):_____

FILE CODING

RESEARCH FOCUS

1. FIELD:
2. AREA(S) OF INTEREST:
3. CONDITION(S) RELEVANT TO INTEREST AREA(S)
4. UNDERLYING PROBLEM(S) OF IDENTIFIED CONDITION(S):
5. RESEARCH FOCUS RELATED TO PROBLEM(S) AND SCOPE DELIMITATIONS:
6. QUESTIONS/PURPOSES/HYPOTHESES:

RESEARCH DESIGN

1. TEST & TREATMENT SEQUENCE:

2. NATURE OF STIMULUS:

Researcher Assigned:
( )Convenience
( )Hypothesis as Relevant to Sample and Study

Subject Assigned:
( )Form selected by subjects
( )Fit historical or use patterns of subject population.

Naturally Occuring:
( )Matched basic nature of natural events
( )Use of naturally occuring events

3. DESIGN CONSTANTS & CONTROLS

Subject Related
( )History
( )Maturation
( )Mortality

Sampling Related
( )Regression
( )Selection

Procedure Related
( )Testing
( )Instrumentation

Interactions
( )Selection/Maturation
( )History/Maturation
( )Testing/Treatment
( )Selection/Treatment
( )History/Maturation/Treatment
( )History/Maturation/Testing/Treatment

4. TESTS/MEASURES

Instrument Type
[ ]Projective
[ ]Direct-Subject
[ ]Direct-Instrument

Instrument Reliability/Validity
[ ]Reported
[ ]Not Reported

Analysis Type & Statistical Tests
[ ]Descriptive_____
[ ]Relational_____
[ ]Instrumentality_____

Data Type
[ ]Nominal
[ ]Ordinal
[ ]Interval
[ ]Ratio

RESEARCH TYPE

( )Historical
( )Critical
( )Descriptive
( )Developmental
Systems Analysis
( )Field
( )Case
( )Casual-Comparative
( )Experimental
( )Field Experimental
( )Action
( )Theory Integration/Extension
( )Philosophical
( )Other_____

5. SAMPLE:
[ ]Convenience Total Size___
[ ]Quota
[ ]Matched
[ ]Random Group Size(s)___
[ ]_____
Population Description:

INDEPENDENT VARIABLES

DEPENDENT VARIABLES

CONCLUSIONS/INFERENCES:

Figure 1

While the individual researcher is expected to develop a defensible decision system related to his or her particular research focus for evaluation of related literature, several guidelines may be suggested in selecting studies for comparative analysis:

1. The research focus should be similar.
2. The nature of conclusions or inferences should be similar.
3. The variable(s) under study should be similar.

These guidelines do not insist that the research type (historical ... Experimental... Philosophical) be similar. It focuses on the researcher's intent and reported claims or results. Thus, studies selected for comparative analysis may not share approaches but do deal with common concerns or intents of the researcher and may be considered "competitive" on that basis.

COMPARISON OF COMPETING STUDIES

A scheme for abstracting some characteristics of studies (step 2) has been outlined and formated (figure 1). Three minimum guidelines for a decision system to identify and select studies for a "competitive" analysis (step 4) have been suggested. Step 5 of the basic process described earlier calls for the "comparison and analysis of competing studies".

One step to such comparisons --which proves to be quite inadequate if more than a very few studies are being considered-- is a simple comparison of the study abstract forms (Figure 1).

An alternate system --which is preferred for comparisons of up to about twenty studies is discussed below.[3]

[3]A matiematical indices approach could also be used but has not attempted.

The most appropriate components for the evaluation of research lie in its very roots, in the processes surrounding it, and the eventual interpretation of its outcomes. Thus, a research project may be considered to be an expression of three generic parts:

1). The "fit" of the research. That is, where the study fits into the structure of the conditions which spawned it: what it relates to, how it relates, and where it doesn't relate.

2). The "strength" of the design. The design controls, the nature of the sample, the artificality of the study setting and the stimulus, and the design sequence.

3). The "applicability" of the outcomes as claimed by the researcher.

The first two of these "fit" and "strength" are dealt with in the four matrices. The third --"applicability"-- is best dealt with by using the study abstract forms.

The Fit of The Research

This part of a study seems to break logically into the following elements:

$$\text{Fit} = \text{A Function of} \left[\text{increasing generalizability of study outcomes}\right] \text{ and } \left[\text{increasing specificity of factors related to the study problem or objective}\right]$$

"Increasing Generalizability" is suggested to be equatable to a combination of a) the type of research, and b) the nature of the case being studied. The continuum "exploratory --relational--causal" seems generally acceptable to research authors in terms of increasing power and generalizability of study outcomes. (It may also be related to specific study types as discussed previously).

The naure of the case being studied is defined in five levels which form a continuum from less to greater power for generalizability:

1. Specific case -- an isolated instance
2. Recurring specific case --repeating or repeatable instance
3. General case --broader, consistent class of instances based upon relevant fact and inference
4. Hypothetical case --broad class of possible instances based upon experience and conjecture.

"Increasing specificity" is suggested by a scale which calls for increasing definition of the research question. While the researcher may stop at any level and designate a "research focus", the study reaching toward root factors or causes demands the delienation of all levels of the scale. The scale levels and an example of them:

Specificity Scale	Example
Field of study identified	Health Care
Area(s) of interest specified	High cost of delivery and low standards
Condition(s) relevant to interest(s) Identified:	1) Lack of Physicians 2) Practice optimization 3) Public education
Underlying problem(s) of identified condition(s): (Using only item 2)	Optimization of Practice a)Patient records b)Patient care audit c)Continuing education for personnel
Research Focus related to problem(s) specified and scope delimited (Using item a)	Patient Records; related to coronary problems; limited to office utilization; sufficiency for emergency situations; etc.

The "fit" matrix for determining the spatial relationships of competing studies is shown in figure 2.

Increasing Generalizability of Outcome		Field study identified	Area(s) of interest specified	Condition(s) relevant to interest(s) ident.	Underlying problems of conditions identified	Research focus related to problem specified and scope delimited
Causal	Hypothetical Case					
	Theoretical Case					
	General Case--Operational					
	Recurring Specific Case					
	Specific Case					
Relational	Hypothetical Case					
	Theoretical Case					
	General Case--Operational					
	Recurring Specific Case					
	Specific Case					
Exploratory	Hypothetical Case					
	Theoretical Case					
	General Case--Operational					
	Recurring Specific Case					
	Specific Case					

Increasing Specificity of Factors Related to Problem

Figure 2: "Fit" of Research

The "Strength" of the Design

Essential elements may be depicted as:

$$\text{Strength of Design} = \text{A Function of} \left[\text{Design Controls}\right] \text{ and } \left[\text{Strength of Sample}\right]$$

Design controls lend themselves to further subclassification:

$$\text{Design Controls} = \text{A Function of} \left[\text{Control of Effects}\right] \text{ and } \left[\text{Control of Measurements}\right]$$

Control of effects might be presented as the matrix in Figure 3. There, the ordinate represents "increasing generalizability of the research design" and the abscissa represents "decreasing artificiality of the stimulus (independent variable(s))".

On the ordinate, the research design types (numbers 1 through 16) correspond to the design configurations suggested by Campbell and Stanley (1963). The user is directed to that work to compare designs in reported research and chart them in the matrix.

Cautions in using this approach are in order. First, Campbell and Stanley consider quasi-experimental designs to be "deemed worthy of use where better designs are not feasible." Such designs are the experimental designs they reference (and which are shown in Figure 3; designs 4, 5, and 6). Their analysis centers on the degree to which sources of internal invalidity are controlled through the design, and to a lesser extent the degree to which sources of external invalidity are controlled. In this regard, the ordering of the designs on the ordinate of the matrix places emphasis on the control of both sources of invalidity but stresses external validity since it ultimately offers the greatest power for generalization.

Figure 3: Control of Effects

The second caution is related to the use of only the design summary tables of Campbell and Stanley in the rating of studies. They caution against such use as a guide to relative strength of various designs without consideration of the discussions of them in their text.

As the ordering on the ordinate suggests, the strength of design of the study is asserted to be the ability of the researcher to get close to reality while controlling sources of invalidity. Intact groups, as substantiated by Campbell and Stanley's design discussions, offer greater positive control over various forms of internal and external invalidity and, therefore, are considered to be of greater design strength.

Figure 3 also stresses the artificiality of the stimulus (or independent variables). As artificiality decreases the strength of the independent variable in offering highly generalizable outputs is deemed to be improved. As shown, decreasing artificiality spans a continuum from those instances where the independent variable or stimulus is experimenter assigned, through those cases where the subjects of the study "assign" it, to those cases where it occurs naturally in the study environment.

That other portion of design controls dealing with the "control of measurements" is shown in Figure 4. In this context, data handling and analysis types are imposed over the various forms of data. Descriptive quantity analysis covers those uses of data not involving statistical significance tests. Relation analyses include those statistical techniques such as correlations which reveal relationships. Instrumentality analyses are those which identify causal relationships. Generalizability increases as analysis type moves toward instrumentality.

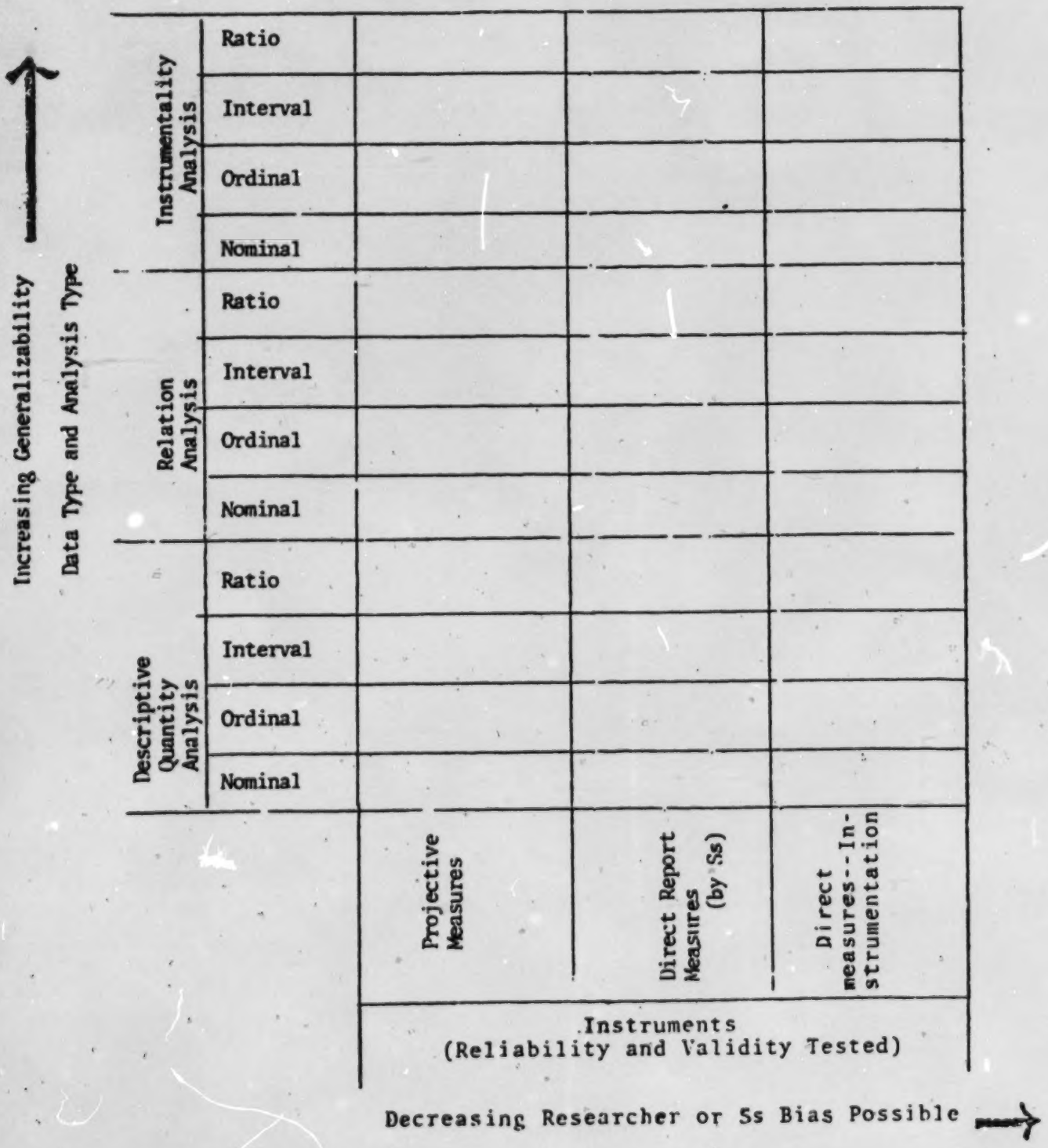


Figure 4: Control of Measurements

Instruments are seen as directly related to the type and strength of data gathered. Projective instruments are seen as potentially open to both subject and researcher error or bias. Direct report measures completed by subjects alone are seen as open to subject error almost exclusively, assuming that the instrument has been examined to assess reliability and validity, and that the transposition or handling of data does not call for researcher interpretation. Direct measures using instrumentation, under this view, would be the ideal method for data collection since subject and researcher error or bias are eliminated or potentially so (assuming proper instrument calibration). To this point we have dealt with the design controls considerations of the "strength" of the design. The "strength of sample" portion is further designed as:

$$\begin{matrix}\text{Strength} \\ \text{of} \\ \text{Sample}\end{matrix} = \begin{matrix}\text{A} \\ \text{Function} \\ \text{of}\end{matrix} \left[\begin{matrix}\text{Sample} \\ \text{Type}\end{matrix}\right] \quad \text{and} \quad \left[\begin{matrix}\text{Sample} \\ \text{Size}\end{matrix}\right]$$

and is illustrated in Figure 5.

As indicated, the sample type is considered to be stronger as it moves toward a probability (random) sample, and the researcher's influence (possible bias) is eliminated. Similarly, the sample type grows stronger with increasing size.

The "Applicability" of Outcomes

As suggested earlier the applicability of outcomes claimed by the researcher may best be dealt with through the use of portions of the study abstract forms (figure 1).

The "applicability" of outcomes claimed must be limited to those protected as fitting to the research at its outset. If not, the researcher is obligated to carefully build a new rationale for the study and the handling of the data and its interpretation.

The portions of the study abstract form most useful for "applicability" analysis are those spanning the bottom of the form."

1) Questions/purposes/ hypotheses

2) Independent variables/dependent variables

3) Conclusions/inferences

In short, the steps up to this point are intended to assist in the minimization of ambiguity so that the outcome of a study or studies may be better evaluated. And, in determining the applicability of claimed outcomes, two questions seem sufficient:

1) Do claimed outcomes relate to the areas of interest claimed for the study, and are they limited to those areas for conclusions claimed as fitting at the outset of the study? Inherent in this, of course, is the justified interpretation of the tests or logic sequences used in relation to the data.

2) Do extensions of the data to unanticipated questions carry with them an established logic? Where, for instance, statistical tests may have failed and the researcher revised his data analysis approach, did he adequately build a logic for his revised handling of the data and for the interpretation of it?

Collective Comparison of Matrices

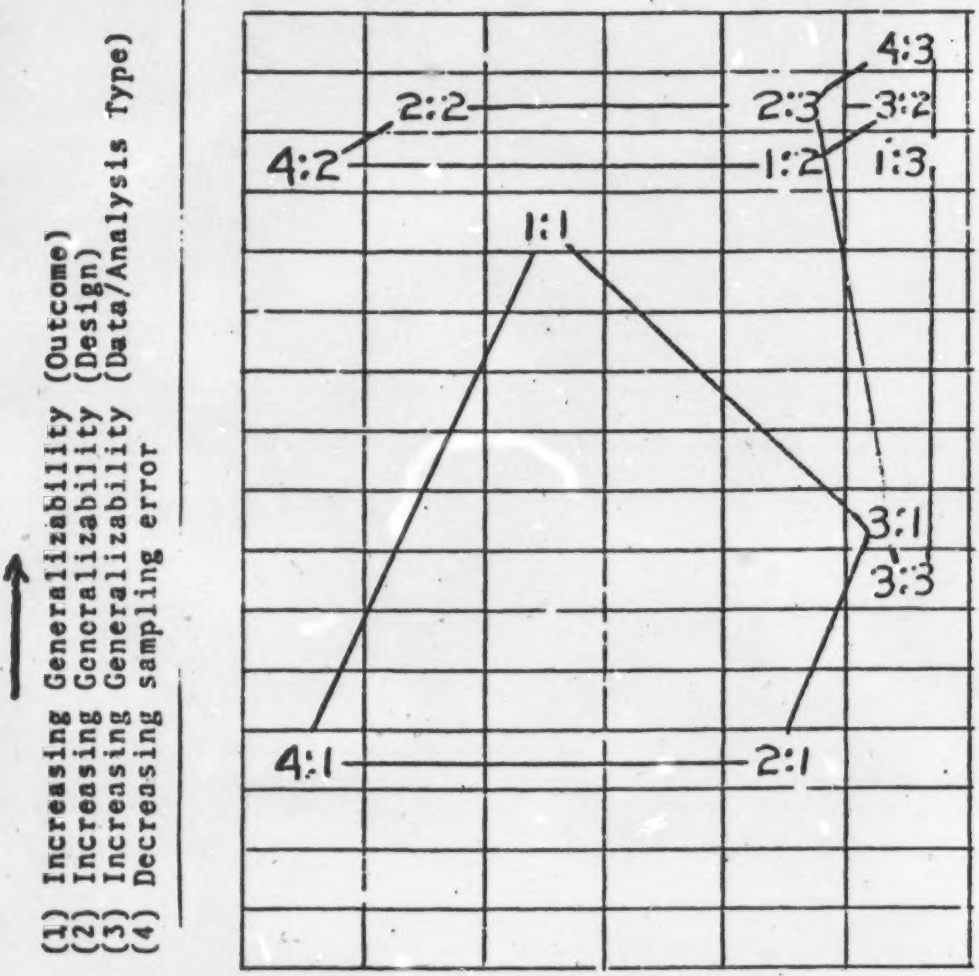
The foregoing approach to the charting of various characteristics of a study or studies offers a method for the comparison of "competing" studies. The "fit" and "strength" of design matrices offer a direct method of charting studies claimed to have similar interests or objectives. Reasonably common characteristics may be compared. Further, all elements may be plotted on a common matrix to show spatial relationships of all studies.

While various elements have been sugg ed as hierarchial in nature and linear relationships between various elements have been inferred, the hint of some firm "goodness" evaluation treads thin ice. However, any "goodness" considerations aside, the matrices do offer a basis for revealing more suscinctly the similarities and differences between conpeting studies. The basic decision, of course, must still be made as to which studies are selected as most worthy or credible. This approach to comparative evaluation of study elements is purely a guide --a "visual aid" and only an aid.

While this approach to the comparison of competing studies has not been broadly used nor systematically reviewed (and there are numerous aspects of it which should be challenged, criticized and improved) it has proved useful to the author on numerous occasions. At the very least it accomplishes a fundamental, systematic review of common factors and reveals differences.

Figure 6 illustrates a comparative spatial relationship of three studies based upon superimposition of the four matrices and the connection of study ratings on each matrix. (The method has been used to chart up to 16 studies).

The three studies plotted focus on measurement of message effectiveness using direct measures. Without regard to outcomes, it would seem that study 3 might be expected to offer more generalizable data (assuming the outcomes are significant). Study 2 would seem to be reasonably placed second, and might be substantially strengthened by an upgrading of sample type. Study 1 emerges as quite weak in many areas. Viewing the outcomes, this odering of studies is defensible.



1:2 = Scale 1
Stuoy 2

Figure 6: Combined Matrices

Conclusion

Some method for more systematic analysis of research literature is needed. The approach outlined herein is useful in that it helps discern basic differences among competing studies.

Some of the scales used can stand improvement. Specifically,

1) The sample size scale is confining for some studies (one of those mentioned above had a sample of over 1000 Ss and a scale calling for "over 150".
2) The stimulus scale (figure 3) could be improved with more specific choices based upon the nature and origin of stimulus form and content. However, the concept of decreasing artificiality of the stimulus being useful for generalization seems sound.
3) The research designs of Campbell and Stanley require considerable interpretation to chart various studies. A better scheme for design analysis is needed (particularly for the quasi-experimental designs).

Improvement of the method could yield rewards. Aside from the ability to get a standard measure of widely varying yet competitive studies, the method (with appropriate quantification) could be applied to the identification of alternative design approaches to a proposed study. This would permit manipulation of various tradeoffs to optimize the design of some types of research in terms of known resources and constraints.

PARTIAL BIBLIOGRAPHY

Brownlee, K.A. Industrial Experimentation. New York: Chemical Publishing Company, Inc., 1953.

Campbell, Donald T. and Stanley, Julian C. Experimental and Quasi-Experimental Designs For Research. Chicago: Rand McHally, Eighth Printing, 1972.

Ferguson, George A. Statistical Analysis in Psychology and Education. New York: McGraw-Hill Book Company, 1966.

Gage, N.L., Editor. Handbook of Research on Teaching. Chicago: Rand McHally, 1963.

Isaac, Stephen and Michael, William B. Handbook in Research and Evaluation. San Diego: Robert R. Knapp, 1971.

Kerlinger, F.N. Foundations of Behavorial Research. New York: Holt, Rinehart and Winston, Inc., 1964.